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|--------------|------|--------------------------------------------------------------------|----------------------------------------------------------------------------|
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|              |      | LIQUID CRYSTAL DISPLAY GROUP<br>SHARP CORPORATION<br>SPECIFICATION | APPLICABLE GROUP<br>LARGE LIQUID CRYSTAL DISPLAY<br>DISPLAY BUSINESS GROUP |

DEVICE SPECIFICATION FOR

**TFT-LCD Cell**

MODEL No. LK0DZ1C0289

CUSTOMER'S APPROVAL

DATEBY

PRESENTED

By



K.TANAKA

GENERAL MANAGER

LIQUID CRYSTAL DISPLAY DIVISION

LARGE LIQUID CRYSTAL DISPLAY GROUP

SHARP CORPORATION



## 1. Application

This specification applies to the color 40.0" TFT-LCD Open Cell LK0DZ1C0289.

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\* Do not use the device for equipment that requires an extreme level of reliability, such as aerospace applications, telecommunication equipment (trunk lines), nuclear power control equipment and medical or other equipment for life support.

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\* Contact and consult with a SHARP sales representative for any questions about this device.

## 2. Overview

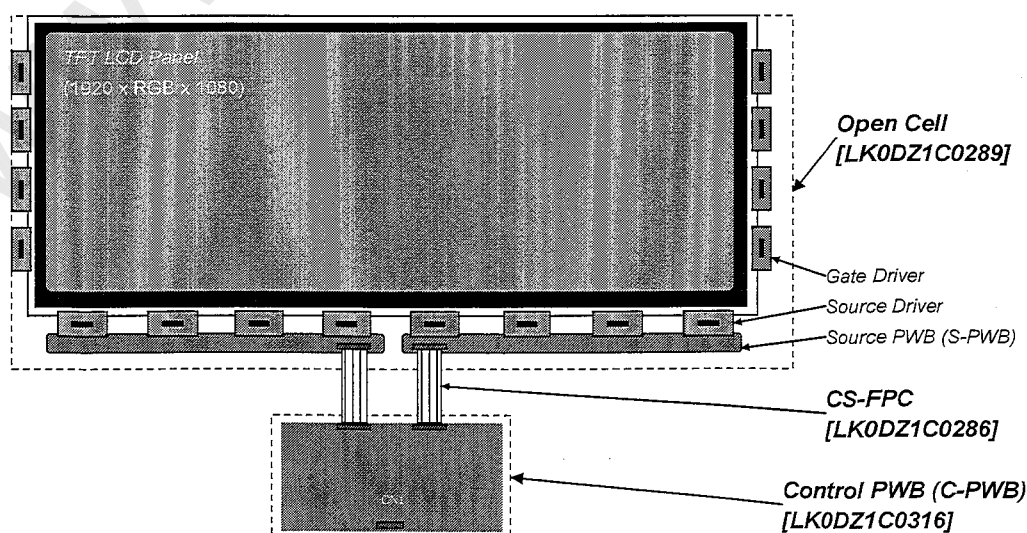
This Open Cell is color active matrix LCD Open Cell incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, driver ICs and Source PWB.

The following contents can be achieved in using LK0DZ1C0316 (C-PWB) and LK0DZ1C0286 (CS-FPC) that SHARP specifies.

Graphics and texts can be displayed on a 1920×RGB×1080 dots panel with one billion colors by using 10bit (8bit+2FRC) LVDS (Low Voltage Differential Signaling) to interface, +12V of DC supply voltages.

And in order to improve the response time of LCD, this module applies the Over Shoot driving (O/S driving) technology for the control circuit. In the O/S driving technology, signals are being applied to the Liquid Crystal according to a pre-fixed process as an image signal of the present frame when a difference is found between image signal of the previous frame and that of the current frame after comparing them.

With combination of these technologies, motion blur can be reduced and clearer display performance can be realized.





### 3. Mechanical Specifications

| Parameter                               | Specifications                                                                                                 | Unit  |
|-----------------------------------------|----------------------------------------------------------------------------------------------------------------|-------|
| Display size                            | 101.609 (Diagonal)                                                                                             | cm    |
|                                         | 40.0036 (Diagonal)                                                                                             | inch  |
| Active area                             | 885.60 (H) x 498.15 (V)                                                                                        | mm    |
| Pixel Format                            | 1920 (H) x 1080 (V)<br>(1pixel = R + G + B dot)                                                                | pixel |
| Pixel pitch                             | 0.461250 (H) x 0.461250 (V)                                                                                    | mm    |
| Pixel configuration                     | R, G, B vertical stripe                                                                                        |       |
| Display mode                            | Normally black                                                                                                 |       |
| Open Cell Outline Dimensions<br>[Note1] | 921.18(W)x 548.55(H) x1.82 (D)                                                                                 | mm    |
| Mass                                    | 1.88 ± 0.3                                                                                                     | kg    |
| Surface treatment<br>[Note2]            | - Front polarizer: Low Haze, Anti Glare<br>Hard coating: 2H and more<br>- Rear polarizer:<br>Hard coating less |       |

[Note1] Outline dimensions are shown in P21.

[Note2] With the protection film removed.



## 4. Open Cell Driving Specifications

### 4.1. Driving interface of C-PWB SHARP specifics [LK0DZ1C0316]

CN1 (Interface signals and +12V DC power supply)

Using connector : FI-RE51S-HF-J (Japan Aviation Electronics Ind., Ltd.)

Matching connector : FI-RE51HL, FI-RE51CL (Japan Aviation Electronics Ind., Ltd.) or equivalent device

Matching LVDS transmitter : THC63LVD1023 or equivalent device

| Pin No. | Symbol   | Function                                       | Remark           |
|---------|----------|------------------------------------------------|------------------|
| 1       | GND      |                                                |                  |
| 2       | Reserved | It is required to set non-connection(OPEN)     |                  |
| 3       | Reserved | It is required to set non-connection(OPEN)     |                  |
| 4       | Reserved | It is required to set non-connection(OPEN)     |                  |
| 5       | Reserved | It is required to set non-connection(OPEN)     |                  |
| 6       | Reserved | It is required to set non-connection(OPEN)     |                  |
| 7       | SELLVDS  | Select LVDS data order [Note1,2]               | Pull up : (3.3V) |
| 8       | Reserved | It is required to set non-connection(OPEN)     |                  |
| 9       | Reserved | It is required to set non-connection(OPEN)     |                  |
| 10      | FRAME    | Frame frequency setting 1:50Hz 0:60Hz [Note 3] | Pull down :GND   |
| 11      | GND      |                                                |                  |
| 12      | AIN0-    | Aport (-)LVDS CH0 differential data input      |                  |
| 13      | AIN0+    | Aport (+)LVDS CH0 differential data input      |                  |
| 14      | AIN1-    | Aport (-)LVDS CH1 differential data input      |                  |
| 15      | AIN1+    | Aport (+)LVDS CH1 differential data input      |                  |
| 16      | AIN2-    | Aport (-)LVDS CH2 differential data input      |                  |
| 17      | AIN2+    | Aport (+)LVDS CH2 differential data input      |                  |
| 18      | GND      |                                                |                  |
| 19      | ACK-     | Aport LVDS Clock signal(-)                     |                  |
| 20      | ACK+     | Aport LVDS Clock signal(+)                     |                  |
| 21      | GND      |                                                |                  |
| 22      | AIN3-    | Aport (-)LVDS CH3 differential data input      |                  |
| 23      | AIN3+    | Aport (+)LVDS CH3 differential data input      |                  |
| 24      | AIN4-    | Aport (-)LVDS CH4 differential data input      |                  |
| 25      | AIN4+    | Aport (+)LVDS CH4 differential data input      |                  |
| 26      | GND      |                                                |                  |
| 27      | GND      |                                                |                  |
| 28      | BIN0-    | Bport (-)LVDS CH0 differential data input      |                  |
| 29      | BIN0+    | Bport (+)LVDS CH0 differential data input      |                  |
| 30      | BIN1-    | Bport (-)LVDS CH1 differential data input      |                  |
| 31      | BIN1+    | Bport (+)LVDS CH1 differential data input      |                  |
| 32      | BIN2-    | Bport (-)LVDS CH2 differential data input      |                  |
| 33      | BIN2+    | Bport (+)LVDS CH2 differential data input      |                  |
| 34      | GND      |                                                |                  |
| 35      | BCK-     | Bport LVDS Clock signal(-)                     |                  |
| 36      | BCK+     | Bport LVDS Clock signal(+)                     |                  |
| 37      | GND      |                                                |                  |
| 38      | BIN3-    | Bport (-)LVDS CH3 differential data input      |                  |
| 39      | BIN3+    | Bport (+)LVDS CH3 differential data input      |                  |
| 40      | BIN4-    | Bport (-)LVDS CH4 differential data input      |                  |
| 41      | BIN4+    | Bport (+)LVDS CH4 differential data input      |                  |
| 42      | GND      |                                                |                  |
| 43      | GND      |                                                |                  |
| 44      | GND      |                                                |                  |
| 45      | GND      |                                                |                  |
| 46      | GND      |                                                |                  |

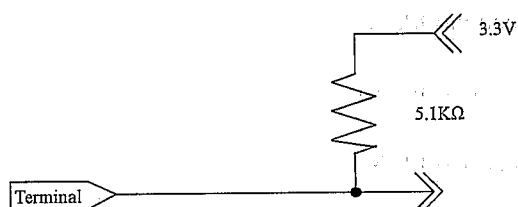


LD-K23507-4

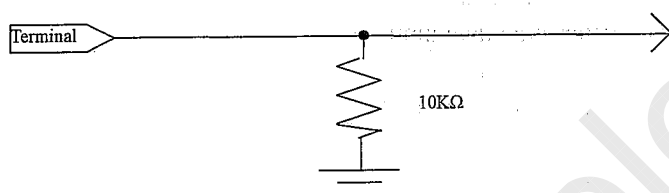
|    |     |                   |  |
|----|-----|-------------------|--|
| 47 | VCC | +12V Power Supply |  |
| 48 | VCC | +12V Power Supply |  |
| 49 | VCC | +12V Power Supply |  |
| 50 | VCC | +12V Power Supply |  |
| 51 | VCC | +12V Power Supply |  |

[NOTE] GND of a liquid crystal panel drive part has connected with a module chassis.

[Note 1] The equivalent circuit figure of the terminal



[Note 3] The equivalent circuit figure of the terminal





LD-K23507-5

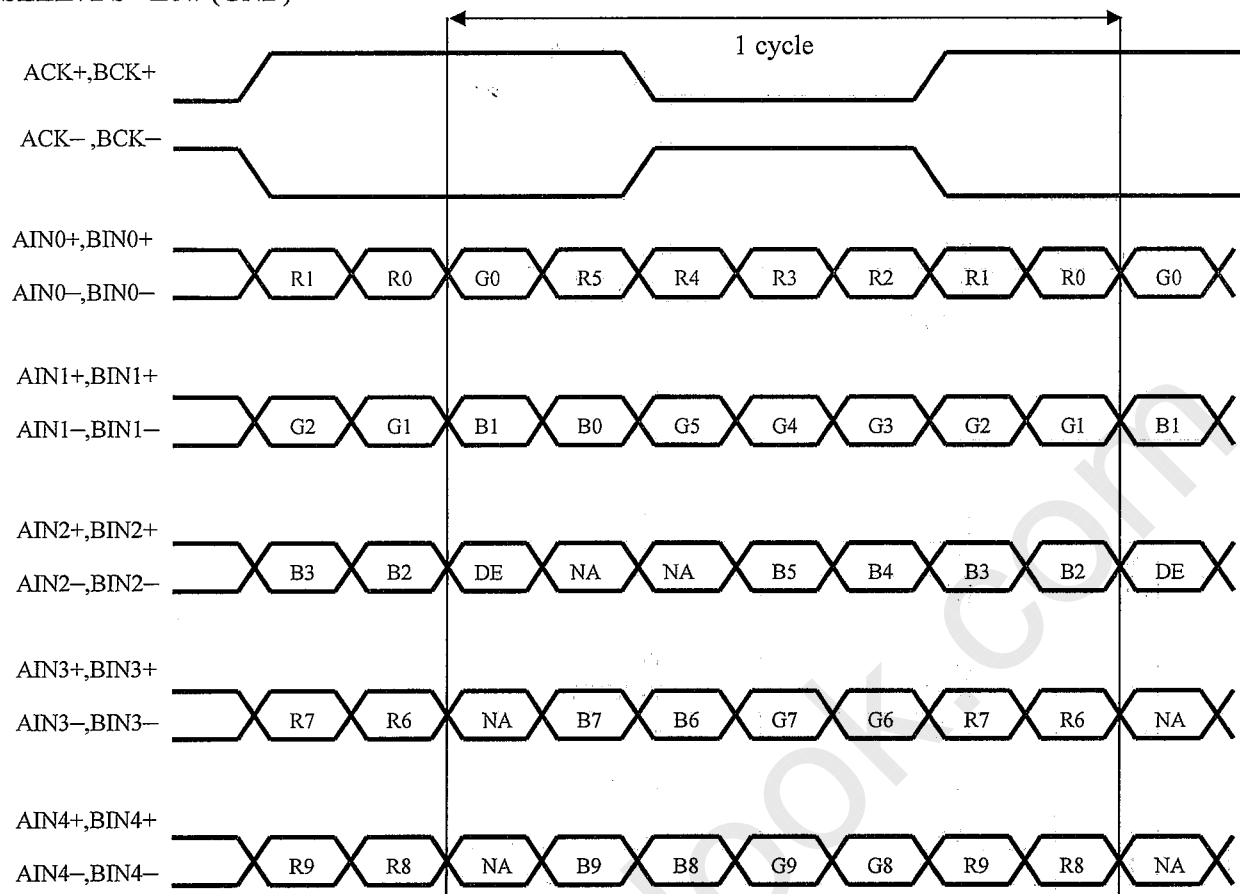
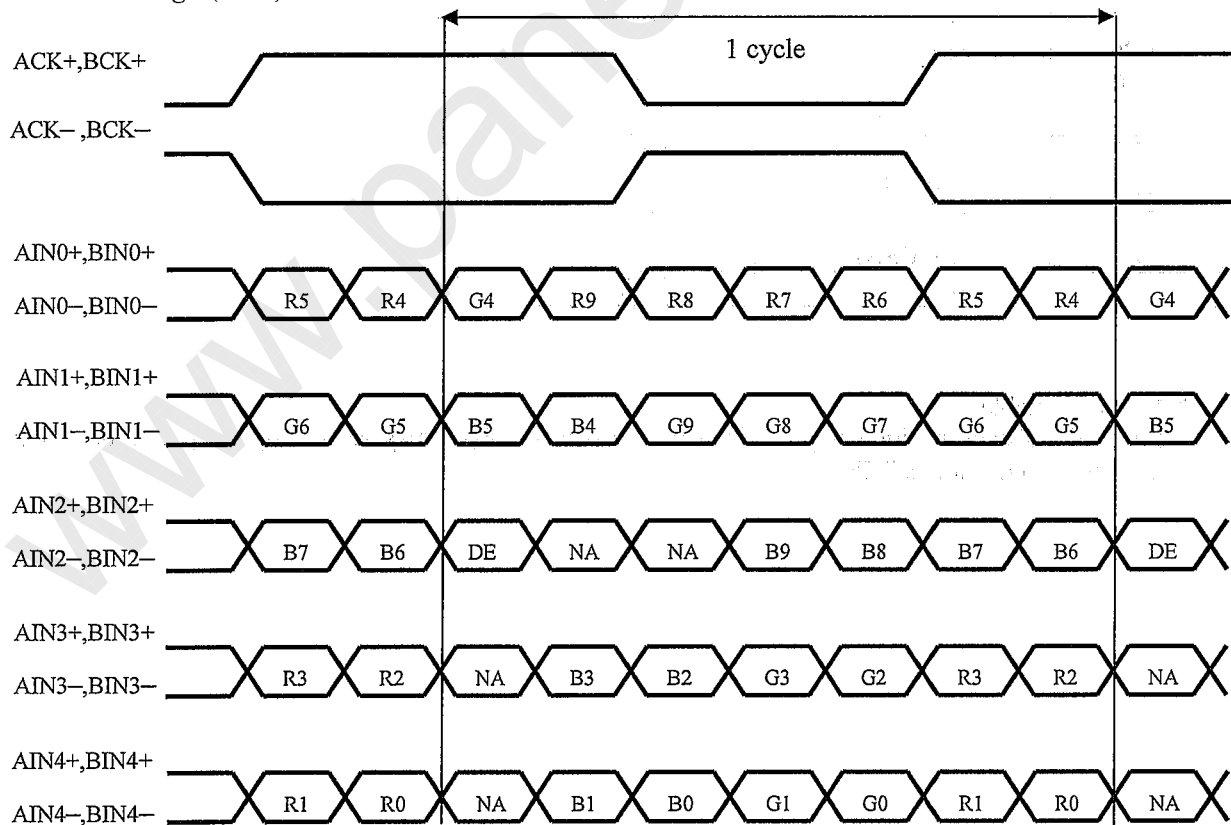
[Note 2] LVDS Data order

| SELLVDS |                  |                            |
|---------|------------------|----------------------------|
| Data    | L(GND)<br>[VESA] | H(3.3V) or Open<br>[JEIDA] |
| TA0     | R0(LSB)          | R4                         |
| TA1     | R1               | R5                         |
| TA2     | R2               | R6                         |
| TA3     | R3               | R7                         |
| TA4     | R4               | R8                         |
| TA5     | R5               | R9(MSB)                    |
| TA6     | G0(LSB)          | G4                         |
| TB0     | G1               | G5                         |
| TB1     | G2               | G6                         |
| TB2     | G3               | G7                         |
| TB3     | G4               | G8                         |
| TB4     | G5               | G9(MSB)                    |
| TB5     | B0(LSB)          | B4                         |
| TB6     | B1               | B5                         |
| TC0     | B2               | B6                         |
| TC1     | B3               | B7                         |
| TC2     | B4               | B8                         |
| TC3     | B5               | B9(MSB)                    |
| TC4     | NA               | NA                         |
| TC5     | NA               | NA                         |
| TC6     | DE(*)            | DE(*)                      |
| TD0     | R6               | R2                         |
| TD1     | R7               | R3                         |
| TD2     | G6               | G2                         |
| TD3     | G7               | G3                         |
| TD4     | B6               | B2                         |
| TD5     | B7               | B3                         |
| TD6     | N/A              | N/A                        |
| TE0     | R8               | R0(LSB)                    |
| TE1     | R9(MSB)          | R1                         |
| TE2     | G8               | G0(LSB)                    |
| TE3     | G9(MSB)          | G1                         |
| TE4     | B8               | B0(LSB)                    |
| TE5     | B9(MSB)          | B1                         |
| TE6     | N/A              | N/A                        |

NA: Not Available

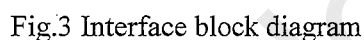
(\*)Since the display position is prescribed by the rise of DE(Display Enable)signal, please do not fix DE signal during operation at "High".



**SELLVDS= Low (GND)****SELLVDS= High (3.3V) or OPEN**

DE: Display Enable, NA: Not Available (Fixed Low)





For the prevention of long-time image sticking of TFT-LCD panel, be sure to adjust Vcom flicker to be minimized on the center of display by visual or flicker meter.

- 
- Diagram illustrating the bit planes of a 10-bit grayscale image. The image is represented as a 10x10 grid of pixels. The bit planes are labeled V0 through V9. The first four bit planes (V0, V1, V2, V3) are grouped together and labeled "1 pixel". The last six bit planes (V4, V5, V6, V7, V8, V9) are grouped together and labeled "1 dot".

[Note] Interface to adjust Vcom

Using Via Hole

Mating connector

### Communication method

: 1.5mm Pitch ( $\phi$  0.7mm )

: (housing)3P-SZN, (contact)SZN-002T-P0.7K (JST Co.,Ltd.)

: I2C

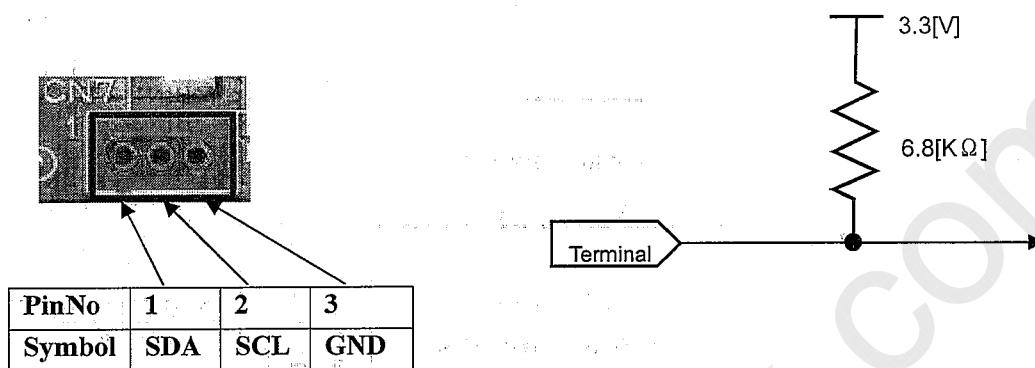


| Pin No. | symbol | Function | Remark               |
|---------|--------|----------|----------------------|
| 1       | SDA    | I2C Data | Pull up 3.3V [Note2] |
| 2       | SCL    | I2C CLK  | Pull up 3.3V [Note2] |
| 3       | GND    | GND      | -                    |

Refer to specifications of ISL24837 for the I2C command of Vcom adjustment.

[Note1]Interface

[Note2] The equivalent circuit figure of the terminal



#### 4.3. Absolute maximum ratings

| Parameter             | Symbol | Condition                | Ratings    | Unit               | Remark   |
|-----------------------|--------|--------------------------|------------|--------------------|----------|
| Input voltage         | $V_I$  | $T_a=25^{\circ}\text{C}$ | -0.3 ~ 3.6 | V                  | [Note 1] |
| 12V supply voltage    | VCC    | $T_a=25^{\circ}\text{C}$ | 0 ~ +14    | V                  |          |
| Storage temperature   | Tstg   | -                        | -25 ~ +60  | $^{\circ}\text{C}$ | [Note 2] |
| Operation temperature | Topa   | -                        | 0 ~ +50    | $^{\circ}\text{C}$ |          |

[Note1] Applies to the input signals to C-PWB

SELLVDS,FRAME

[Note2] Applies to the LK0DZ1C0289 (OpenCell) and C-PWB, CS-FPC

- Humidity: 95%RH Max. ( $T_a \leq 40^{\circ}\text{C}$ )
- Maximum wet-bulb temperature at  $39^{\circ}\text{C}$  or less. ( $T_a > 40^{\circ}\text{C}$ )
- No condensation.



## 4.4. Electrical characteristics of input signals

Ta=25°C

| Parameter                              |                     | Symbol            | Min.                | Typ. | Max.                         | Unit              | Remark                            |
|----------------------------------------|---------------------|-------------------|---------------------|------|------------------------------|-------------------|-----------------------------------|
| +12V supply voltage                    | Supply voltage      | V <sub>CC</sub>   | 11.4                | 12   | 12.6                         | V                 | [Note1]                           |
|                                        | Current dissipation | I <sub>CC</sub>   | -                   | 0.7  | 1.4                          | A                 | [Note2]                           |
|                                        | Inrush current      | I <sub>RUSH</sub> | -                   | 4.74 | -                            | A                 | t <sub>1</sub> =500μs<br>[Note7]  |
| Permissible input ripple voltage       |                     | V <sub>RP</sub>   | -                   | -    | 100                          | mV <sub>P-P</sub> | V <sub>CC</sub> = +12.0V          |
| Input Low voltage                      |                     | V <sub>IL</sub>   | 0                   | -    | 0.7                          | V                 | [Note3]                           |
| Input High voltage                     |                     | V <sub>IH</sub>   | 2.3                 | -    | 3.3                          | V                 |                                   |
| Input leak current (Low)               |                     | I <sub>IL1</sub>  | -                   | -    | 400                          | μA                | V <sub>I</sub> = 0V<br>[Note4]    |
|                                        |                     | I <sub>IL2</sub>  | -                   | -    | 40                           | μA                | V <sub>I</sub> = 0V<br>[Note5]    |
| Input leak current (High)              |                     | I <sub>IH1</sub>  | -                   | -    | 40                           | μA                | V <sub>I</sub> = 3.3V<br>[Note 4] |
|                                        |                     | I <sub>IH2</sub>  | -                   | -    | 400                          | μA                | V <sub>I</sub> = 3.3V<br>[Note5]  |
| Terminal resistor                      |                     | R <sub>T</sub>    | -                   | 100  | -                            | ohm               | Differential input                |
| Input Differential voltage             |                     | V <sub>ID</sub>   | 200                 | 400  | 600                          | mV                | [Note6]                           |
| Differential input common mode voltage |                     | V <sub>CM</sub>   | V <sub>ID</sub>  /2 | 1.2  | 2.4-<br> V <sub>ID</sub>  /2 | V                 | [Note6]                           |

[Note] V<sub>CM</sub>: Common mode voltage of LVDS driver.

[Note 1]

Input voltage sequences

$$50\mu\text{s} < t_1 \leq 20\text{ms}$$

$$20 < t_2 \leq 50\text{ms}$$

$$20 < t_3 \leq 50\text{ms}$$

$$0 < t_4 \leq 1\text{s}$$

$$300\text{ms} \leq t_5$$

$$0 \leq t_6$$

$$300\text{ms} \leq t_7$$

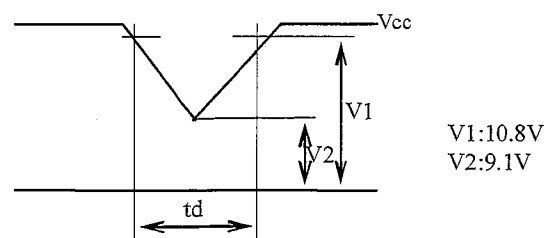
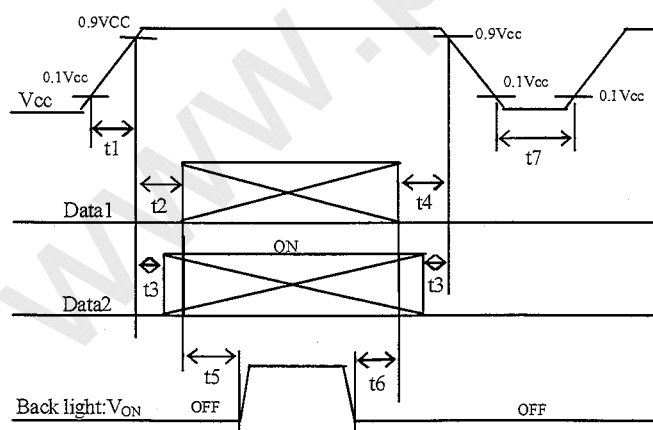
Dip conditions for supply voltage

$$\text{a) } 9.1\text{V} \leq V_{CC} < 10.8\text{V}$$

$$t_d \leq 10\text{ms}$$

$$\text{b) } V_{CC} < 9.1\text{V}$$

Dip conditions for supply voltage is based on input voltage sequence.



※ Data1: ACK±, AIN0±, AIN1±, AIN2±, AIN3±, AIN4±, BCK±, BIN0±, BIN1±, BIN2±, BIN3±, BIN4±

\*V<sub>CM</sub> voltage pursues the sequence mentioned above

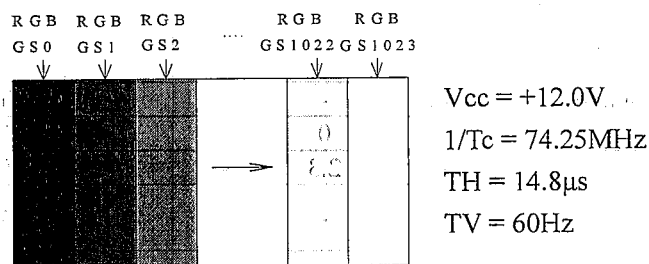
Data2: SELLVDS, FRAME

[Note] About the relation between data input and back light lighting, please base on the above-mentioned input sequence. When back light is switched on before panel operation or after a panel operation

stop, it may not display normally. But this phenomenon is not based on change of an incoming signal, and does not give damage to a liquid crystal display.

[Note2] Typical current situation: 1024 gray-bar patterns. ( $V_{cc} = +12.0V$ )

The explanation of RGB gray scale is seen in section 4.8.

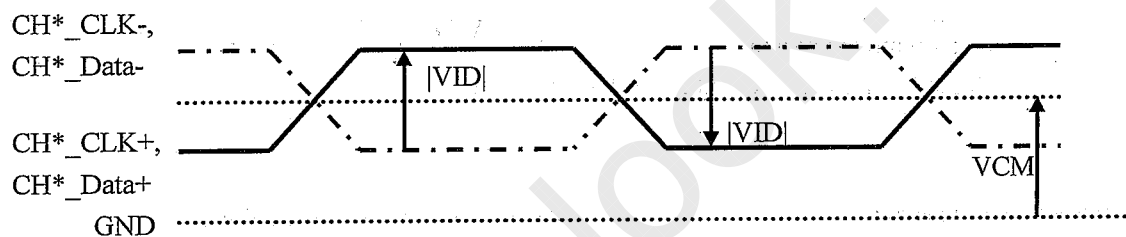


[Note 3] SELLVDS, FRAME

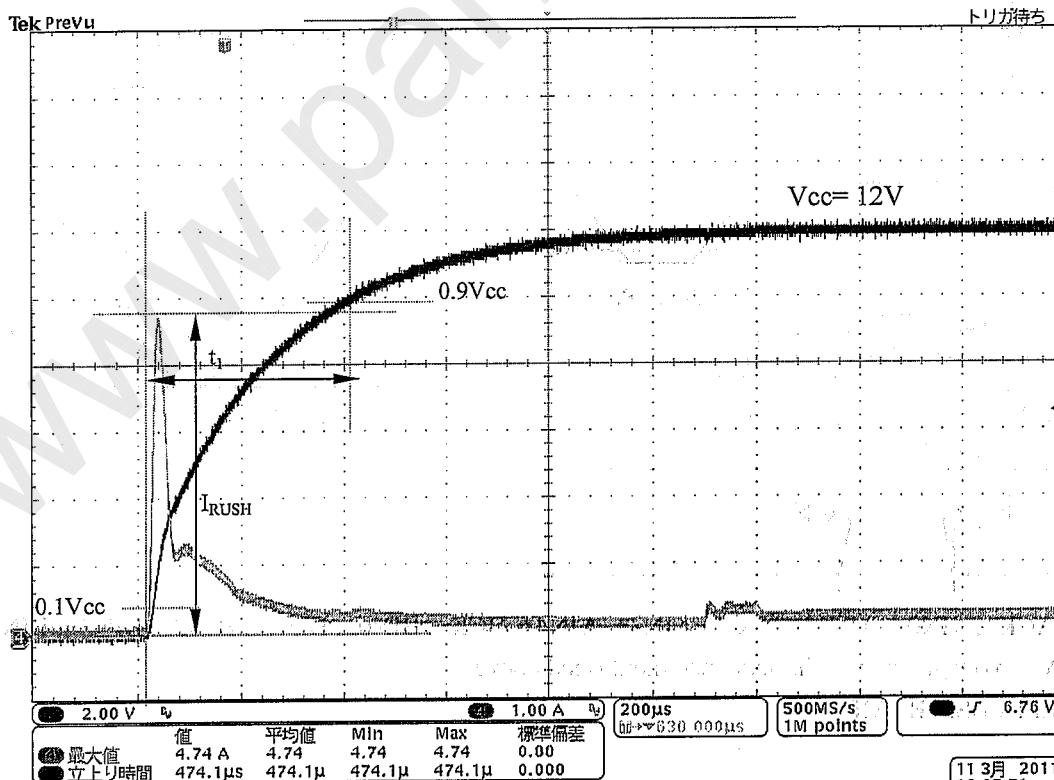
[Note 4] SELLVDS

[Note5] FRAME

[Note 6] LVDS differential data and Clock signal ( $AIN0 \sim 4\pm$ ,  $BIN0 \sim 4\pm$ ,  $ACK\pm$ ,  $BCK\pm$ )



[Note 7]  $V_{cc}12V$  inrush current waveform





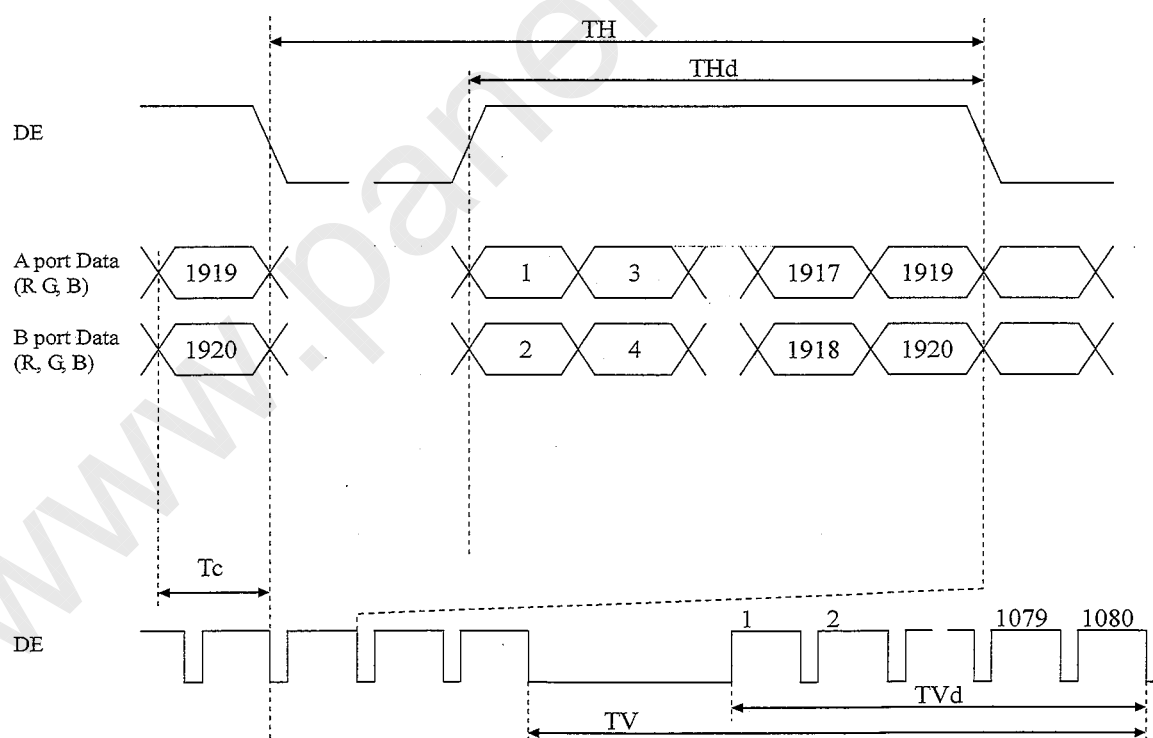
#### 4.5. Timing characteristics of input signals

Timing diagrams of input signal are shown in below figure.

| Parameter          |                          | Symbol | Min. | Typ.  | Max. | Unit  | Remark |
|--------------------|--------------------------|--------|------|-------|------|-------|--------|
| Clock              | Frequency                | 1/Tc   | 67   | 74.25 | 76   | MHz   |        |
| Data enable signal | Horizontal period        | TH     | 1050 | 1100  | 1300 | clock |        |
|                    |                          |        | 14.2 | 14.8  | 16.1 | μs    |        |
|                    | Horizontal period (High) | THd    | 960  | 960   | 960  | clock |        |
|                    | Vertical period          | TV     | 1109 | 1350  | 1400 | line  |        |
|                    |                          |        | 47   | 50    | 60   | Hz    |        |
|                    | Vertical period (High)   | TVd    | 1080 | 1080  | 1080 | line  |        |

[Note]

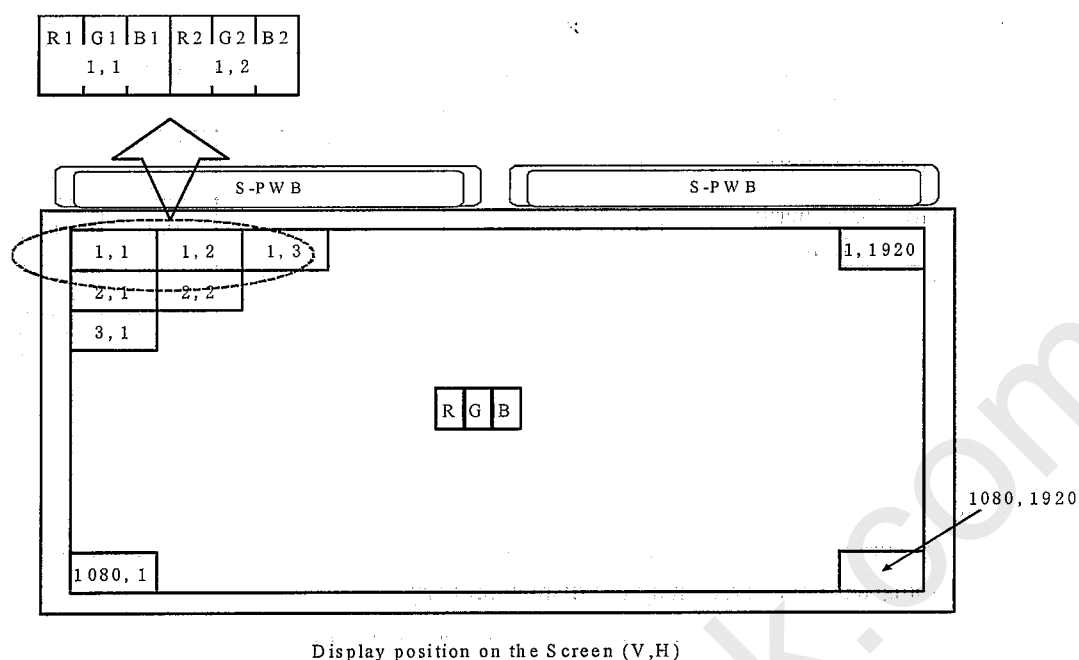
- When vertical period is very long, flicker and etc. may occur.
- Please turn off the module after it shows the black screen.
- Please make sure that length of vertical period should become of an integral multiple of horizontal length of period. Otherwise, the screen may not display properly.
- As for your final setting of driving timing, we will conduct operation check test at our side, please inform your final setting.



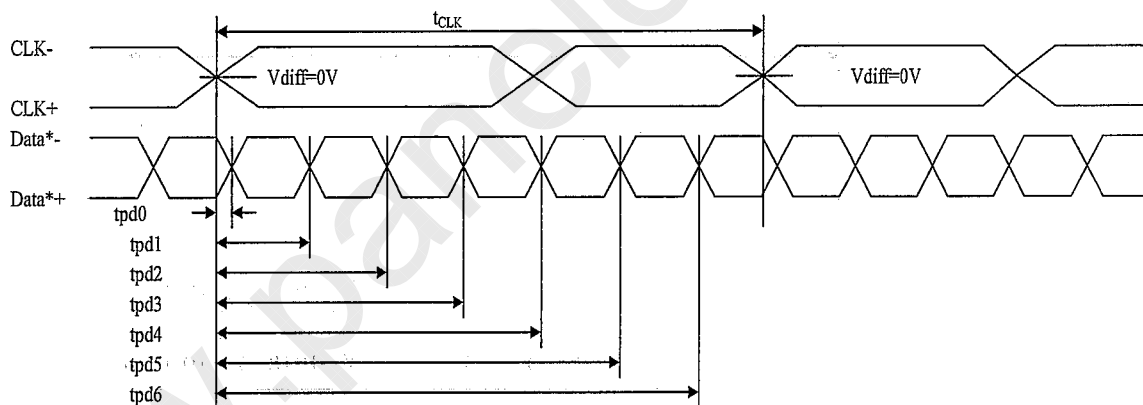
Timing diagram of input signal



#### 4.6. Input data signal and display position on the screen



#### 4.7. LVDS signal characteristics



| Item              |                                                      | Symbol           | Min.                       | Typ.                  | Max.                       | Unit |
|-------------------|------------------------------------------------------|------------------|----------------------------|-----------------------|----------------------------|------|
| LVDS Clock Period |                                                      | t <sub>CLK</sub> | 13.16                      | 13.47                 | 14.93                      | ns   |
| Data position     | Delay time, CLK rising edge to serial bit position 0 | tpd0             | -0.25                      | 0                     | 0.25                       | ns   |
|                   | Delay time, CLK rising edge to serial bit position 1 | tpd1             | 1*t <sub>CLK</sub> /7-0.25 | 1*t <sub>CLK</sub> /7 | 1*t <sub>CLK</sub> /7+0.25 |      |
|                   | Delay time, CLK rising edge to serial bit position 2 | tpd2             | 2*t <sub>CLK</sub> /7-0.25 | 2*t <sub>CLK</sub> /7 | 2*t <sub>CLK</sub> /7+0.25 |      |
|                   | Delay time, CLK rising edge to serial bit position 3 | tpd3             | 3*t <sub>CLK</sub> /7-0.25 | 3*t <sub>CLK</sub> /7 | 3*t <sub>CLK</sub> /7+0.25 |      |
|                   | Delay time, CLK rising edge to serial bit position 4 | tpd4             | 4*t <sub>CLK</sub> /7-0.25 | 4*t <sub>CLK</sub> /7 | 4*t <sub>CLK</sub> /7+0.25 |      |
|                   | Delay time, CLK rising edge to serial bit position 5 | tpd5             | 5*t <sub>CLK</sub> /7-0.25 | 5*t <sub>CLK</sub> /7 | 5*t <sub>CLK</sub> /7+0.25 |      |
|                   | Delay time, CLK rising edge to serial bit position 6 | tpd6             | 6*t <sub>CLK</sub> /7-0.25 | 6*t <sub>CLK</sub> /7 | 6*t <sub>CLK</sub> /7+0.25 |      |



## 4.8. Input signal, basic display colors and gray scale of each color

| Colors & Gray Scale |         |        | Data signal |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|---------------------|---------|--------|-------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
|                     |         |        | R0          | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | R9 | G0 | G1 | G2 | G3 | G4 | G5 | G6 | G7 | G8 | G9 | B0 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 |
| Basic Color         | Black   | —      | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Blue    | —      | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|                     | Green   | —      | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Cyan    | —      | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|                     | Red     | —      | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Magenta | —      | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|                     | Yellow  | —      | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | White   | —      | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
| Gray Scale of Red   | Black   | GS0    | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | ---     | GS1    | 1           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | ---     | GS2    | 0           | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | ---     | ---    |             |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|                     | ---     | ---    |             |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|                     | ---     | GS1021 | 1           | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | ---     | GS1022 | 0           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Red     | GS1023 | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| Gray Scale of Green | Black   | GS0    | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | ---     | GS1    | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | ---     | GS2    | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | ---     | ---    |             |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|                     | ---     | ---    |             |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|                     | ---     | GS1021 | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | ---     | GS1022 | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Green   | GS1023 | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| Gray Scale of Blue  | Black   | GS0    | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | ---     | GS1    | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | ---     | GS2    | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | ---     | ---    |             |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|                     | ---     | ---    |             |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|                     | ---     | GS1021 | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|                     | ---     | GS1022 | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|                     | Blue    | GS1023 | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |

- 0: Low level voltage / 1: High level voltage

- Each basic color can be displayed in 1021 gray scales from 10 bits data signals. According to the combination of total 30 bits data signals, one billion-color display can be achieved on the screen.





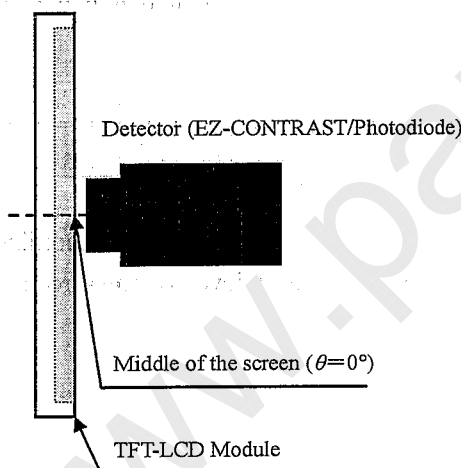
## 5. Optical characteristics

Ta=25°C, Vcc=12.0V, ILED=1.35A frame rate: 60Hz (typ.value)

| Parameter            |            | Symbol                         | Condition                 | Min.  | Typ.  | Max.  | Unit              | Remark      |
|----------------------|------------|--------------------------------|---------------------------|-------|-------|-------|-------------------|-------------|
| Viewing angle range  | Horizontal | $\theta_{21}$<br>$\theta_{22}$ | $CR \geq 10$              | 70    | 88    | -     | Deg.              | [Note1,4]   |
|                      | Vertical   | $\theta_{11}$<br>$\theta_{12}$ |                           | 70    | 88    | -     | Deg.              |             |
| Contrast ratio       |            | CRn                            | $\theta = 0 \text{ deg.}$ | 3750  | 5000  | -     |                   | [Note2,4]   |
| Response time        |            | $\tau_{DRV}$                   |                           |       | 6     |       | ms                | [Note3,4,5] |
| Chromaticity         | White      | x                              |                           | 0.245 | 0.275 | 0.305 | -                 | [Note4]     |
|                      |            | y                              |                           | 0.255 | 0.285 | 0.315 | -                 |             |
|                      | Red        | x                              |                           | 0.623 | 0.653 | 0.683 | -                 |             |
|                      |            | y                              |                           | 0.303 | 0.333 | 0.363 | -                 |             |
|                      | Green      | x                              |                           | 0.252 | 0.282 | 0.312 | -                 |             |
|                      |            | y                              |                           | 0.604 | 0.634 | 0.664 | -                 |             |
|                      | Blue       | x                              |                           | 0.117 | 0.147 | 0.177 | -                 |             |
|                      |            | y                              |                           | 0.045 | 0.075 | 0.105 | -                 |             |
| Luminance            | White      | $Y_L$                          |                           | 400   | 450   | -     | cd/m <sup>2</sup> |             |
| Luminance uniformity | White      | $\delta w$                     |                           |       |       | 1.25  |                   | [Note 6]    |

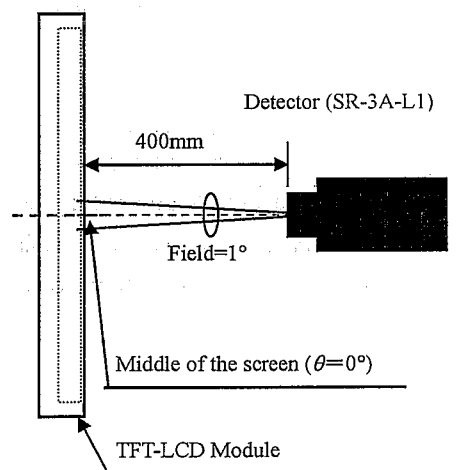
- Optical characteristics are based on SHARP standard module.
- The measurement shall be executed 60 minutes after lighting at rating.

[Note] The optical characteristics are measured using the following equipment.



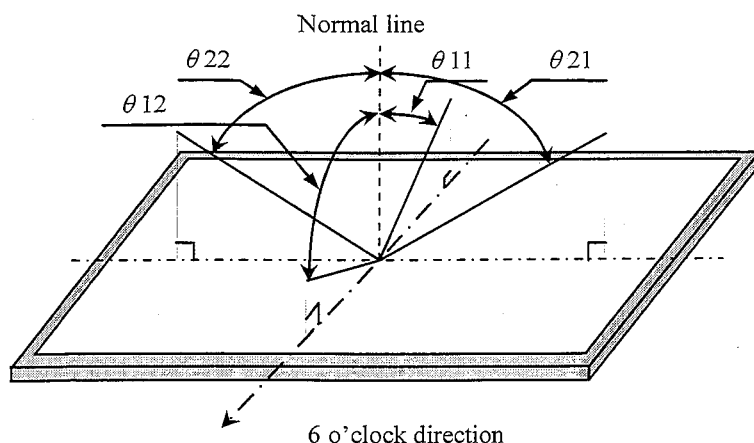
Measurement of viewing angle range and Response time.

- Viewing angle range: EZ-CONTRAST
- Response time: Photodiode



Measurement of Contrast, Luminance, Chromaticity.

[Note1] Definitions of viewing angle range:



[Note2] Definition of contrast ratio:

The contrast ratio is defined as the following.

$$\text{Contrast Ratio} = \frac{\text{Luminance (brightness) with all pixels white}}{\text{Luminance (brightness) with all pixels black}}$$

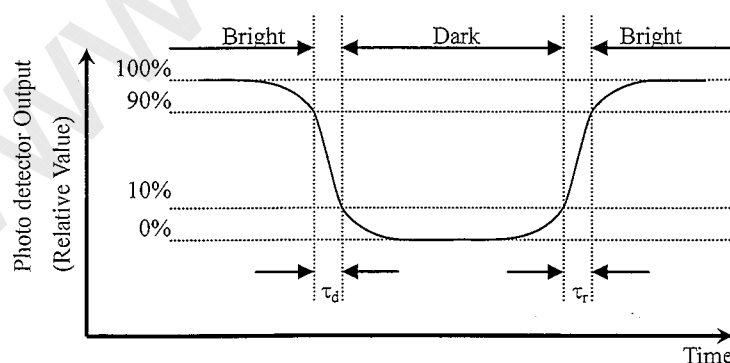
[Note3] Definition of response time

The response time ( $\tau$ ) is defined as the following figure and shall be measured by switching the input signal for “any level of gray (0%, 25%, 50%, 75% and 100%)” and “any level of gray (0%, 25%, 50%, 75% and 100%)”.

|      | 0%          | 25%          | 50%          | 75%          | 100%         |
|------|-------------|--------------|--------------|--------------|--------------|
| 0%   |             | tr: 0%-25%   | tr: 0%-50%   | tr: 0%-75%   | tr: 0%-100%  |
| 25%  | td: 25%-0%  |              | tr: 25%-50%  | tr: 25%-75%  | tr: 25%-100% |
| 50%  | td: 50%-0%  | td: 50%-25%  |              | tr: 50%-75%  | tr: 50%-100% |
| 75%  | td: 75%-0%  | td: 75%-25%  | td: 75%-50%  |              | tr: 75%-100% |
| 100% | td: 100%-0% | td: 100%-25% | td: 100%-50% | td: 100%-75% |              |

t\*:x-y --- response time from level of gray(x) to level of gray(y)

$$\tau = \sum (t^* : x - y) / 20$$



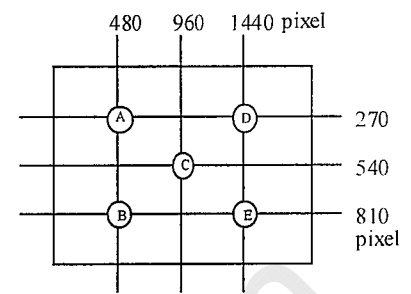
[Note4] This value shall be measured at center of the screen.

[Note5] This value is valid when O/S driving is used at typical input time value.



[Note6] This value is calculated as the following with nine measurements. (A~E)

$$\delta w = \frac{\text{Maximum luminance of five points (brightness)}}{\text{Minimum luminance of five points (brightness)}}$$





## 6. Packing for shipping

### 6.1. Packing form

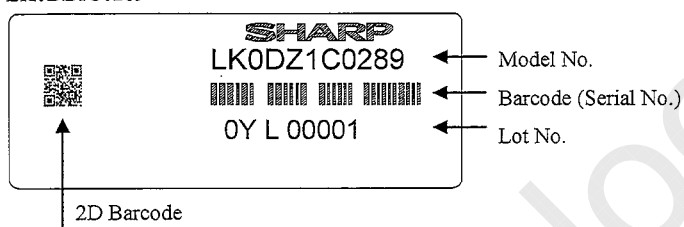
- |                                                        |                                       |
|--------------------------------------------------------|---------------------------------------|
| a) Open Cell quantity in 1 cell box                    | : 15 cells                            |
| b) Piling number of cell box                           | : 14 cell box/ 1 palette              |
| c) 1 palette size                                      | : 1390 (W) x 1150 (D) x 1059 (H) [mm] |
| d) Total mass of 1 palette filled with full open cells | : 490.5 kg (Max)                      |

### 6.2. Label

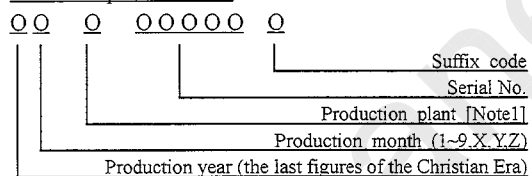
#### a) Open Cell Label

This label is stuck on the protection film of front polarizer.

ex) LK0DZ1C0289



How to express Lot No.



[Note1] Production plant code

| Code | Plant | Model No. & Suffix Code |
|------|-------|-------------------------|
| L,K  | Japan | LK0DZ1C0289             |

#### b) Packing label

This label is stuck on the cell box and palette.

ex) LK0DZ1C0289

- ① Model No.& Suffix Code
- ② Lot No.
- ③ Quantity



## 7. Reliability test item

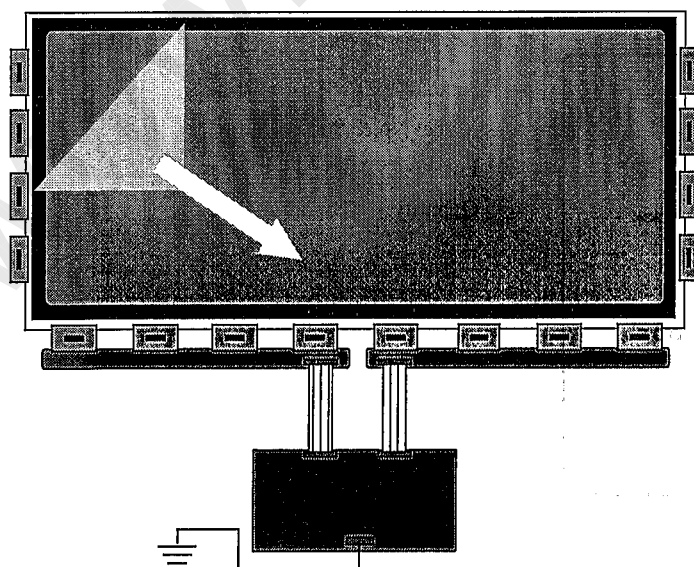
| No. | Test item                                                     | Condition                                                                                                             |
|-----|---------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| 1   | High temperature storage test (Open Cell)                     | Ta = 60°C 240h                                                                                                        |
| 2   | Low temperature storage test (Open Cell)                      | Ta = -25°C 240h                                                                                                       |
| 3   | High temperature and high humidity operation test (Open Cell) | Ta = 40°C 95%RH 240h (No condensation)                                                                                |
| 4   | High temperature operation test (Open Cell)                   | Ta = 50°C 240h                                                                                                        |
| 5   | Low temperature operation test (Open Cell)                    | Ta = 0°C 240h                                                                                                         |
| 6   | Vibration test (Cell Box with full Open Cells)                | X and Y direction: 15min, Z direction: 60min.<br>5Hz to 50Hz acceleration velocity: 1.0G<br>Sweeping ratio: 3min      |
| 7   | Drop test (Cell Box with full Open Cells)                     | Height: 25cm (corner and edge), 32cm (surface)<br>Number: 8times<br>(corner 1time and edge 3times and surface 4times) |

[Result evaluation criteria]

Under the display quality test condition with normal operation state, there shall be no change, which may affect practical display function.

## 8. Precautions

- Be sure to turn off the power supply when inserting or disconnecting the cable.
- Be sure to design the module and cabinet so that the Open Cell can be installed without any extra stress such as warp or twist.
- Since the polarizer is easily damaged, pay attention not to scratch it.
- Since long contact with water may cause discoloration or spots, wipe off water drop immediately.
- When the polarizer is soiled, wipe it with absorbent cotton or other soft cloth.
- Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface. Handle with care.
- Precautions of peeling off the protection film.



- Be sure to peel off slowly (recommended more than 5sec) and constant speed.
- Peeling direction shows Fig.
- Be sure to ground person with adequate methods such as the anti-static wrist band.
- Be sure to ground S-PWB while peeling of the protection film.
- Ionized air should be blown over during peeling action.
- The protection film must not touch drivers and S-PWBs.
- If adhesive may remain on the polarizer after the protection film peeling off, please remove with isopropyl-alcohol.



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- h) Since the Open Cell consists of TFT and electronic circuits with CMOS-ICs, which are very weak to electrostatic discharges, persons who are handling the Open Cell should be grounded through adequate methods such as the anti-static wrist band. Connector pins should not be touched directly with bare hands.

- Reference : Process control standard of sharp

|   | Item                                               | Management standard value and performance standard    |
|---|----------------------------------------------------|-------------------------------------------------------|
| 1 | Anti-static mat (shelf)                            | 1 to 50 [M ohm]                                       |
| 2 | Anti-static mat (floor, desk)                      | 1 to 100 [M ohm]                                      |
| 3 | Ionizer                                            | Attenuate from $\pm 1000V$ to $\pm 100V$ within 2 sec |
| 4 | Anti-static wrist band                             | 0.8 to 10 [M ohm]                                     |
| 5 | Anti-static wrist band entry and ground resistance | Below 1000 [ohm]                                      |
| 6 | Temperature                                        | 22 to 26 [°C]                                         |
| 7 | Humidity                                           | 60 to 70 [%RH]                                        |

- i) The Open Cell has some PWBs, take care to keep them from any stress or pressure when handling or installing the Open Cell, otherwise some of electronic parts on the PWBs may be damaged.
- j) When handling the Open Cell and assembling them into module and cabinets, please be noted that long-term storage in the environment of oxidization or deoxidization gas and the use of such materials as reagent, solvent, adhesive, resin, etc. which generate these gasses, may cause corrosion and discoloration of the Open Cell.
- k) Applying too much force and stress to PWB and driver (COF) may cause a malfunction electrically and mechanically.
- l) The Open Cell has high frequency circuits. Sufficient suppression to EMI should be done by system manufacturers.
- m) Please be careful since image retention may occur when a fixed pattern is displayed for a long time.
- n) The chemical compound, which causes the destruction of ozone layer, is not used.
- o) This Open Cell is corresponded to RoHS. "R.C." label on the side of palette shows it.
- p) When any question or issue occurs, it shall be solved by mutual discussion.

## 9. Carton storage condition

|                     |                                                                                                                                                                                                                                                          |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Temperature         | 0°C to 40°C                                                                                                                                                                                                                                              |
| Humidity            | 95% RH or less                                                                                                                                                                                                                                           |
| Reference condition | 20°C to 35°C, 85% RH or less (summer)<br>5°C to 15°C, 85% RH or less (winter)<br>the total storage time (40°C, 95% RH) : 240h or less                                                                                                                    |
| Sunlight            | Be sure to shelter a production from the direct sunlight.                                                                                                                                                                                                |
| Atmosphere          | Harmful gas, such as acid and alkali which bites electronic components and/or wires must not be detected.                                                                                                                                                |
| Notes               | Be sure to put cartons on palette or base, don't put it on floor, and store them with removing from wall.<br>Please take care of ventilation in storehouse and around cartons, and control changing temperature is within limits of natural environment. |
| Storage life        | 1 year.                                                                                                                                                                                                                                                  |

## 10. Caring for the Liquid Crystal panel

General instructions of "Caring for the Liquid Crystal panel" to our customer are as follows;

1. Gently wipe the surface of the display panel with a soft cloth (cotton, flannel, etc.).  
Wiping with a hard cloth or using strong force may scratch the surface of the display panel.
2. Use a soft damp cloth to gently wipe the display panel when it is really dirty.  
(It may scratch the surface of the display panel when wiped strongly.)
3. If the display panel is dusty, use an anti-static brush, which is commercially available, to clean it.
4. To protect the display panel, do not use a dirty cloth, liquid cleaners, or a chemical cloth (wet/dry sheet type cloth, etc.).

This may damage the surface of the display panel.

### \*Note

Recommended treatment for the surface of Polarizer

1. Do not touch the surface of the Polarizer.  
When transporting or working on the display, handle with care not to touch the Polarizer.
2. Use an anti-static brush, if the surface of the Polarizer is dusty.  
Take care of damages and stains of the brush.
3. Do not stack the display modules.
4. Clean with following steps, if stains are on the surface.
  - a) Wipe with an approved clean cloth.
  - b) Breathe on the stain and wipe.
  - c) Wipe with a clean cloth dampened with minimum quantity of IPA diluted with water.

### "Caution"

:Do not use too much solvent.

It may cause spots, and the risk of scratches will increase to clean the spots.

:Take care of damages and stains of a cloth.

A change of cloths must be required regularly.

Old cloths may scratch the Polarizer.

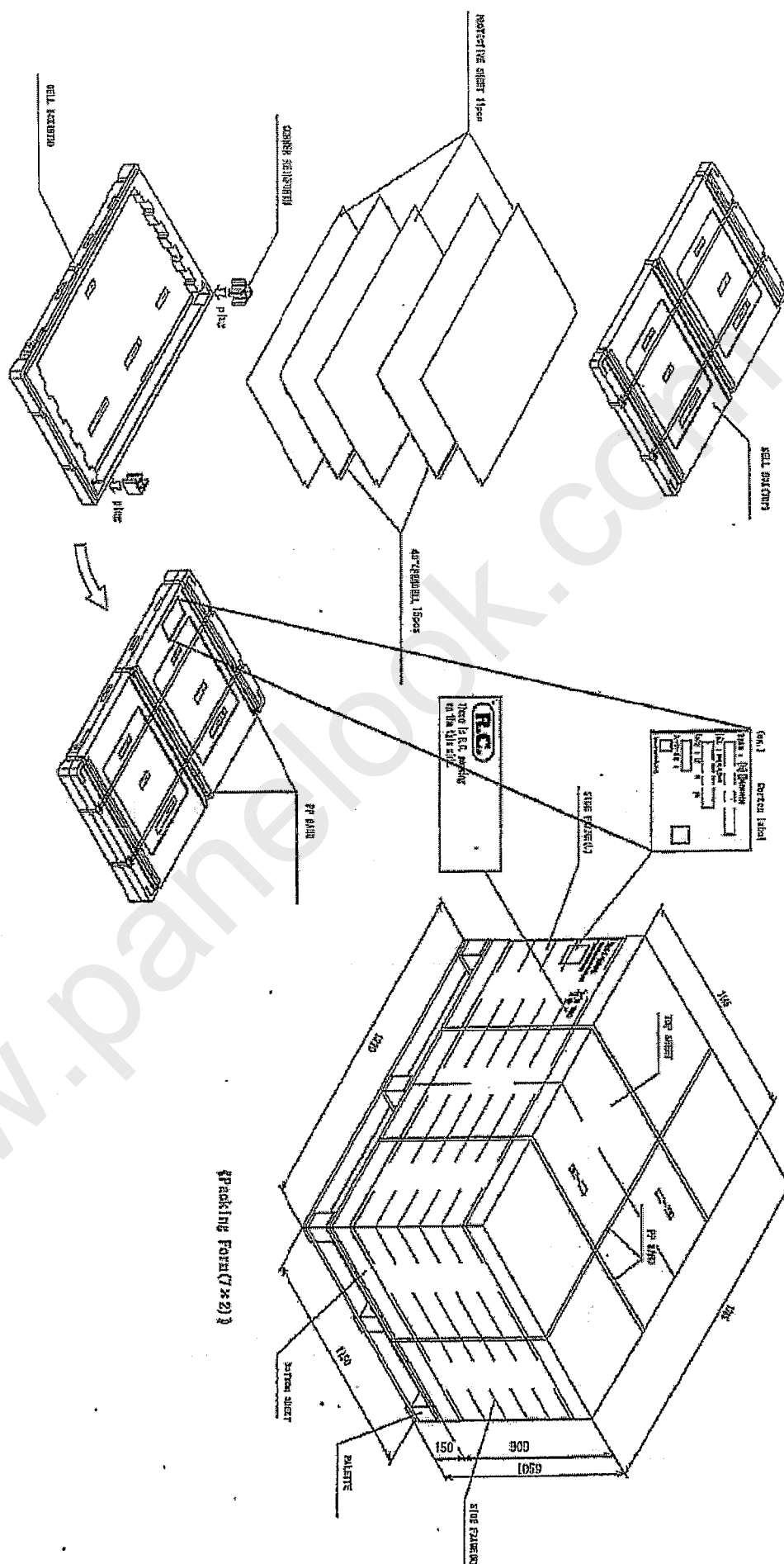
:Make sure that the treatment is appropriate, first.



Fig.4 LK0DZ1C0289



LD-K23507-22



| PIECES NAME            | MATERIAL   |
|------------------------|------------|
| 1 CELL BOX (bottom)    | EPS        |
| 2 CELL BOX (top)       | EPS        |
| 3 CORNER REINFORCEMENT | LDPE       |
| 4 PROTECTIVE SHEET     | Wardner    |
| 5 SIDE FRAME           | Corrugated |
| 6 PALLETTE             | Plywood    |
| 7 PROTECTIVE SHEET     | PP (0.1mm) |

40 INCH OPENCELL Packing Form